



MISSOURI DEPARTMENT OF NATURAL RESOURCES

Safe Handling and Destruction of Anhydrous Ammonia Containers

Technical Bulletin

11/05

Division of Field Services
Environmental Services Program

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General Information

Over the past few years, Missouri law enforcement, fire service, and other emergency response officials have been extensively involved with the seizure and/or cleanup of clandestine methamphetamine labs. One of the primary health and safety risks associated with clandestine methamphetamine labs involves containers or cylinders containing anhydrous ammonia (hereafter containers).

Anhydrous ammonia is a precursor used in one of the methods to produce methamphetamine. Most often the containers consist of standard propane tanks found on gas grills. However, anhydrous ammonia has also been discovered in other various pressurized containers such as oxygen cylinders, fire extinguishers and air tanks. The valves and fittings on these containers are not designed to come in contact with a corrosive material like anhydrous ammonia. Anhydrous ammonia corrodes the brass valving on these containers often turning the brass a blue/green color (Figure 1). Anhydrous ammonia will attack the brass valving from the inside out. The valve may appear intact from the outside, however, it may be heavily corroded and brittle on the inside. Consequently, there is a high degree of risk when handling these containers. Non-pressurized containers such as coolers, thermos bottles, plastic drums, and other miscellaneous containers may be used to store anhydrous ammonia (Figures 2 and 3).



Figure 1: Brass valve corrosion from anhydrous ammonia on a propane cylinder valve.



Figure 2: Premix tank containing anhydrous ammonia.



Figure 3: Blue poly drum containing anhydrous ammonia (notice the frost).

Anhydrous Ammonia Characteristics

Anhydrous ammonia is used as an agricultural fertilizer and industrial refrigerant and therefore is commonly found at agricultural retailers and facilities with ammonia refrigeration systems. The term “anhydrous” describes an inorganic compound that does not contain water. Because anhydrous ammonia contains no water, it is attracted to any form of moisture. Anhydrous ammonia is considered both a compressed liquid and nonflammable gas, as well as corrosive. It is stored under pressure as a liquid and upon release to the atmosphere will expand 850 times in volume and can produce large toxic vapor clouds. Anhydrous ammonia is slightly lighter than air and is highly soluble in water. It has a strong, penetrating, pungent odor.

Characteristics of Anhydrous Ammonia

Appearance: Colorless alkaline gas and liquid

Boiling Point: -28° F

Vapor Pressure: 124 psi @ 68° F

Solubility in Water: Highly soluble

Odor Threshold: 5 ppm

Odor: Penetrating pungent odor

Specific Gravity (water=1): 0.60 @ 68° F

Vapor Density (air=1): 0.60 @ 32° F

IDLH: 300 ppm

Personal Protective Equipment and Safety

Because of anhydrous ammonia's corrosivity and its affinity for moisture, it is extremely important to protect mucous membranes and skin from exposure. Exposure to anhydrous ammonia can cause severe burns to the skin and eyes, respiratory injury, or even death. An inhalation exposure to 300 parts per million (ppm) is considered “immediately dangerous to life and health” (IDLH).

To prevent exposures, personnel should remain upwind of anhydrous ammonia containers. Personal protective equipment (PPE) must always be worn when handling containers of anhydrous ammonia. Standard PPE should include long pants and a long-sleeved shirt or coveralls, rubber gloves with thermal lining, and non-vented goggles with a face shield or an air-purifying respirator (APR).

When anhydrous ammonia concentrations are unknown or above the IDLH, a self-contained breathing apparatus and a fully-encapsulated chemical resistant suit must be worn. **In these circumstances, contact your local hazardous materials response team or the Missouri Department of Natural Resources Environmental Emergency Response (EER) 24-hour spill notification telephone number at 573-634-2436 for assistance.** NIOSH's “Recommendations for Chemical Protective Clothing” or reference material provided by PPE manufacturers should be consulted to determine appropriate materials for fully-encapsulated suits. Clothing contaminated with anhydrous ammonia should be removed as soon as possible and placed in a closed container. Contaminated clothing should be laundered before wearing again or discarded.

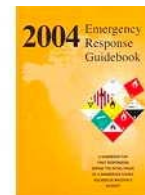
Decommissioning Containers

Containers should always be handled with care. Avoid touching the valves or fittings, especially if the blue/green color or heavy corrosion is found on the valving. Every effort should be made to decommission (destruct) containers at the site where they are encountered if the site conditions allow for this practice. **If site conditions are not ideal, refer to the Packaging and Transporting section of this document.**

Site Selection

Ensure the site conditions are adequate prior to decommissioning any containers at the site where they are encountered or at any site selected. The site should be in a rural

area away from any roadways, residences or livestock operations. The 2004 North American Emergency Action Guide "Table of Initial Isolation and Protective Action Distances" (green colored pages) for anhydrous ammonia should be used to determine if the site is of adequate size to safely decommission containers. Anhydrous ammonia can be found in the guidebook under guide number 125 of the orange pages. The UN number for anhydrous ammonia is 1005 and is placarded as a Class 2.2 nonflammable gas.



Decommissioning

Containers that are non-pressurized should be opened carefully so that the anhydrous ammonia flows from the container (Figure 4). The container may be very cold and in poor condition, therefore, extreme care should be used when handling the container.



Figure 4: Anhydrous ammonia flowing from a non-pressurized container.

While emptying the container, ensure everyone is upwind at a safe distance. Anhydrous ammonia may remain inside the container after the initial discharge, therefore, the container may have to be moved or turned to release the remaining anhydrous ammonia. The container should be rinsed with water after the anhydrous ammonia has been removed. It is advisable to have at least one other person to monitor wind conditions, vapor dispersal direction, and any other safety aspects. This also assures the buddy

system is being used as required under Occupational Safety and Health Administration (OSHA) regulations for any hazardous materials site work.

Containers may also be decommissioned with a firearm. This is recommended for pressurized containers such as propane tanks or cylinders, but it may also be used for non-pressurized containers. The site used for this method of decommissioning should be fairly flat and have an earthen backstop or other inert material to prevent projectile ricochet. The responder must consider the trajectory of the rifle projectiles and the possibility of container movement during the procedure. The pressure release at the time of projectile impact may cause the containers to become unstable or launch into the air. It is good practice to lean the containers against the backstop or secure them to minimize potential movement (Figure 5).



Figure 5. Containers leaning against a wall

The individual shooting the containers must be a safe distance from the containers during the procedure. The distance actually used by the shooter depends on site conditions. Ensure the buddy system is used as required by OSHA as mentioned previously. Thick steel walled containers such as medical containers or compressed gas cylinders may require the use of full metal jacket ammunition (Table 1). **Take special care with medical cylinders as they may contain oxygen or other flammable gasses under high pressure (Figure 6). Oxygen can increase the chance of a fire or explosion. These cylinders have been known to violently release their contents and travel considerable distances. If you encounter these, take special care to restrain them and increase setback distances.**



Figure 6. Oxygen Cylinders

Table 1.

| CALIBER | BULLET TYPE/SIZE (grains) | DISTANCE OF EFFECTIVENESS (yards) |
|--------------------------|-----------------------------------|--------------------------------------|
| PROPANE CYLINDERS | | |
| 223 | Full Metal Jacket/55 | 50-200 |
| 30-06 | Full Metal Jacket/143,150, &168 | 50-250 |
| 308 | Full Metal Jacket/146 & 147 | 50-200 |
| 7.62 x 39mm | Full Metal Jacket/123 | 50-75 |
| MEDICAL CYLINDERS | | |
| 223 | Full Metal Jacket/55 | 50-150* |
| 30-06 | Full Metal Jacket/143, 150, & 168 | 50-200* |
| 308 | Full Metal Jacket/146 & 147 | 50-150* |

* The distance of effectiveness depends on the cylinder metal type and thickness. Heavier welding gas or military cylinders may require shorter distances to be effective.

It is important to place a sufficient number of projectile holes in each container. The number of holes depends on the firearm caliber and size of the container. Normally, three to six holes are adequate. It is also important to place the projectile holes in the top, middle, and bottom of the container. Proper projectile placement allows for the safe and efficient release of anhydrous ammonia from the container.



Figure 7. Anhydrous Ammonia releasing from a container.

It is recommended that the first hole be placed as low as possible on the container to allow any compressed gas to force liquid out of the bottom of the container (Figure 7).

This will reduce the amount of time it takes for all liquid to drain from the container. To complete decommissioning, containers can be overturned and holes placed in the underside and top area near the valve.

Containers releasing anhydrous ammonia may take up to several hours to completely empty their contents. Anhydrous ammonia may only partly release vapor and liquid before “freezing over” and not releasing any more anhydrous ammonia. This phenomenon causes the container to become colder than the boiling point and show frost on the outside of the container. Once this happens the container will have to be heated by a water spray or allowed to volatize for a

few hours. Make sure containers have been fully purged of all liquid and vapors prior to handling. Adequate time must be allowed for all anhydrous ammonia to vaporize from the containers. Containers may be rinsed with copious amounts of water. Any container rinsing must be done in proper PPE including an APR or SCBA. The local fire department can often assist with rinsing the containers. **Ideally, this rinsing should be done so that the rinse water will not enter a natural waterway. The water can be safely applied as fertilizer to a cleared field. Personnel should be aware that the water may be caustic(have a high pH) and may cause irritation or burning through contact with exposed skin.**

Should on-site conditions not allow for safe decommissioning, then the containers must be properly packaged for transportation to a safe site for decommissioning or to a Missouri Clandestine Drug Lab Collection Station.

PACKAGING AND TRANSPORTING

If the containers must be transported off-site for decommissioning, they should be packaged in an overpack container, such as a polyethylene overpack, or strapped securely to the transport vehicle. If the container is inside an overpack, packing material (kitty litter, sand, oil dry, etc.) should be added to keep the container from “shifting” during transportation. The container should be transported in a vehicle that has a cargo area separate from the driver/passenger area (e.g. pickup truck, enclosed trailer). **If you do not have an overpack container, use blankets to wrap the cylinder and valving to minimize vapors in case of a release and secure the load.** The driver and passenger(s) must be ready to get upwind in case a container releases a significant amount of anhydrous ammonia. To the extent possible, travel routes should avoid highly populated areas. **Label the container as a Nonflammable Corrosive Gas and/or fill out Meth Lab Emergency Response Shipping Papers. This will warn first responders in case you are involved in an accident during transit.**

REGULATORY

The agency conducting the decommissioning is responsible for the release of the anhydrous ammonia. If a reportable quantity of anhydrous ammonia (100 pounds or greater) is released when you decommission a container, you must report the release immediately to the National Response Center at 800-424-8802.

CONTAINER DISPOSAL

After the containers are completely empty of anhydrous ammonia, they should be disposed of properly. The containers can be disposed of as solid waste, but it is recommended that metal containers be taken to a metal recycler. The recycling facility or landfill may require the containers to be cut or otherwise made unusable in addition to the projectile holes resulting from the decommissioning procedure. Contact the MDNR Environmental Services Program at 573-751-3315 for a list of metal recyclers or if you have any questions.

For more information call or write:

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